Albertans & Climate Change:

A Strategy for Managing Environmental & Economic Risks

February 2002

Alberta

GOVERNMENT OF ALBERTA

INTRODUCTION:

Alberta is committed to doing its part to manage the risks of climate change by thinking globally and acting locally.

Alberta's strategy is to work with other provinces, territories and the federal government to shape national climate change strategies that are environmentally effective and economically sustainable. It includes a commitment to work with the federal government to help shape international agreements, but at the same time ensure any such commitments or any national plans or programs reflect the commitments, actions and objectives of Albertans.

CONTEXT:

In 1998, the Government of Alberta clearly stated its commitment to manage climate change risks. Since then the provincial government has been a leader and partner both at the national level – working collaboratively with other governments to develop a phased national strategy – and within Alberta – working collaboratively with all sectors of Alberta society to demonstrate an Alberta approach to reducing emissions, while continuing to build Alberta's communities and economy.

Albertans support action on climate change. They do not, however, see a difference between climate change and the Kyoto Protocol. They are also not aware that Kyoto does not "solve" the climate change issue, nor do they understand the possible costs to the average Albertan, or the impact on the overall economy.

According to a recent economic analysis conducted by the province, the potential costs to Alberta will likely be negative, likely decreasing growth in the economy by $3-5.5 billion per year, or two to three per cent of the annual economy.

However, the analysis also shows costs to Alberta depend on three things:

- The reductions required within the province
- The policies implemented in Canada to cause the emission reductions
- The price of international credits/reductions

The first is subject to negotiation, the second should involve collaborative federal-provincial/territorial design as well as negotiation, and the third is uncertain.

Alberta has long been active on climate change both within the federal-provincial and territorial process as a leader, and as a partner in encouraging action by Alberta organizations. Comments from both government and industry partners vary from, "Alberta is providing the only leadership in this country on climate change" to "I want to see one action that indicates Alberta is seriously committed to responding to climate change and the Kyoto Protocol."
While we need to take action on climate change, the federal commitment to the Kyoto Protocol creates a real challenge to the economies of Canada.

Therefore, Alberta is calling for a solution that may take longer than the timelines outlined by the Kyoto Protocol, but would make sense, be cost effective and achieve better long-term emission reduction results.

ALBERTA'S POSITION:

Alberta recognizes and strongly agrees that climate change is a growing concern to all Canadians, and there is no question that some action must be taken to address the issue.

However, as a province we are just as concerned about our nation's competitiveness and economic well being. As a result we are extremely concerned that Canada's current proposed action on climate change could significantly impact employment, economic growth and investment opportunities across Canada.

Specifically, our concern stems from the fact that much of the work and analysis of the National Climate Change Process, established in 1998, was undertaken before the decision by the U.S. to withdraw from the Kyoto Protocol.

With the importance of trade and investment between Canada, the U.S., and Mexico, we feel any actions or programs undertaken by Canada to address climate change must be developed in a North American context.

Discussions on climate change between Canada, the U.S. and Mexico are vital to ensuring Canadian business and industry is on a level competitive playing field with economies that are so closely linked to our own. Within that context, we believe we can develop an appropriate national plan that will help us live up to our international commitments to take action on climate change.

A successful climate change response will require action, support and ownership of the issue from all jurisdictions. If we take the right action, Canada can and will make a global contribution, as well as reap the related benefits for our own environment and way of life.

However, we cannot overstress the importance of making a fully informed decision.

Need for a National Plan:

Alberta wants to work cooperatively with the federal government, and other provincial and territorial governments, to develop a national plan that:

- Allows Alberta to retain control over this issue and consequently control over our resource development.
- Limits the costs, liability and competitiveness risk for Canada's private sector.
- Minimizes the costs to Albertans and the economy as a whole through efficient solutions and limited liability.
- Incorporates an agreed upon set of principles that produce real greenhouse gas reductions, and mutually agreed upon outcomes.

The national plan should also recognize that meeting world greenhouse gas targets cannot be achieved within Canada alone, and the federal government will need to ensure its approach is part of a strong international effort.

The response to climate change cuts across all sectors, political jurisdictions and ecological regions of Canada. This means that effective action on climate change involves both federal and provincial/territorial jurisdictions. Effective action, policy certainty, and equitable results require broad and informed consultation with the public and agreement on policies and strategies.

Following Kyoto, Alberta agreed along with other governments in Canada on the need to work together as full partners to develop a full and complete understanding of options prior to a decision on Kyoto.

Alberta remains committed to its word.

PRINCIPLES:

In 1998, Alberta's Cabinet announced a climate change strategy that drew heavily on the recommendations of community leaders from around the province. That strategy included several principles to guide the development of Alberta's climate change response.

Those principles subsequently have been reaffirmed, and new ones added in numerous provincial and national discussions, within the context of Canada's potential ratification of the Kyoto Agreement:

- We need a shared understanding of the range of real costs of our climate change response.
- We need informed consultation with engaged stakeholders and the public.
- We must ensure our climate change response does not put Canada at a competitive disadvantage.
- We must work collaboratively, ensuring respect for provincial, territorial and federal jurisdictional responsibilities.
- No province, territory, industry or sector will be treated unfairly.
- In the short term, industry should use new technology reducing emissions intensity. For the longer term, we need investment in technologies that break the relationship between emissions and economic growth.
- All Canadians must be part of the climate change solution.
- We need to focus on energy conservation and efficiency.

OBJECTIVES:

Alberta's strategy is to take action to address climate change, while balancing economic risks and realities for Alberta consumers, business and industry.

To that end, the goals of the proposed plan for Alberta are to:

- Limit costs and uncertainties of short-term climate change response
- Retain control over the management of Alberta's resources and environment
- Manage longer-term climate change risks, including:
  - Make a responsible environmental contribution
  - Reduce vulnerability of Alberta economy to future greenhouse gas limits
  - Adapt to address probable impacts of climate change on the province

The specific objectives of Alberta's strategy on climate change is two-fold:

- Influence federal decision-making and national policy.
- Demonstrate the province's commitment to address climate change by taking immediate actions that will reduce greenhouse gas emissions in an orderly and cost-effective way over the long-term.

ACTION PLAN:

Short and longer-term actions to support the two-prong approach will be in the areas of:

- Government Leadership
- Energy Conservation
- Carbon Management
- Technology and Innovation
- Establishing Frameworks to Encourage Improved Farm and Forest Management that Enhance Carbon Storage (i.e. sinks)
- Preparing to Adapt to the Changing Climate

Action in these areas is interactive and overlapping. Alberta's influence on the federal government, as well as on other provincial governments will be improved by taking strong and effective action in Alberta now and in the longer term. Conversely, Alberta's action plan needs to be linked to national decision-making in order to get the most out of our actions.

SHORT-TERM ACTIONS:

Timelines:

Immediate

Objective:

- Influence federal decision-making and national policy.

Activities & Initiatives:

(led by Alberta Environment (AENV), with involvement of Alberta International and Intergovernmental Relations (IIR), Alberta Energy and other provincial ministries as required):

- Urge the federal government to work vigorously with the U.S. on climate change solutions.
- Strongly encourage the federal government to commit funding to purchase international credits (for example in Africa, China and India) to help keep the costs of Kyoto low in Canada and to make a real impact and benefit to developing countries.
- Work towards a national plan that is compatible with Alberta's plan and does not result in the Alberta economy paying twice.
- Clearly communicate Alberta's concerns, as well as actions and solutions, to Albertans, the federal government, other provincial and territorial governments and all Canadians, and help facilitate an educated and constructive discussion on a made-in-Canada solution to climate change.

MEDIUM- AND LONG-TERM RESULTS:

Timelines:

Beginning February 2002, and on-going.

Objectives:

- Clearly demonstrate Alberta's commitment to taking action on climate change.
- Better educate and engage all Albertans to take action on climate change.
- Establish practices and programs that will reduce greenhouse gas emissions, and actively address climate change.

Activities & Initiatives:

- Provide leadership to help advance a national domestic emissions trading system that will result in real reductions as soon as possible and gives industry a highly efficient tool to minimize their costs *(led by AENV)*
  - Should the national emissions trading system not advance, Alberta will be prepared to advance a provincial emissions trading system, defining an acceptable allocation system (i.e. using covenants or regulatory instruments, such as a declining cap on emissions)
- Continue to develop Alberta's economy, while reducing our exposure to future greenhouse gas reductions by:
  - Investing in technology research and development to increase the efficiency of energy production *(led by Alberta Energy Research Institute (AERI), with AENV)*
  - Investing in carbon management programs related to capture and utilizing CO2 in geologic environments *(led by Energy with Alberta Innovation and Science (I&S) and AENV)*

- Pursuing forest and agricultural management opportunities to enhance biological sinks in Alberta *(AENV, Alberta Sustainable Resource Development (SRD) & Alberta Agriculture, Food and Rural Development (AAFRD))*
- Investing in the development of an alternative fuels strategy that would begin to move towards a hydrogen economy *(AERI, Energy, and AENV)*

- Develop and lead an aggressive, provincial energy conservation strategy *(co-led by AENV & Energy)* with the following objectives:
  - Increase access to diverse energy sources
  - Show government leadership through action
  - Increase public education and awareness
  - Demonstrate and encourage action, possibly through financial incentives

SUMMARY:

The federal government appears committed to moving as quickly as possible to ratify the Kyoto Protocol and agreement, which will formally commit Canada to an internationally administered compliance program to reduce its greenhouse gas emissions by 2010 and beyond.

If Canada ratifies the agreement as it stands today, and without better understanding of the potential impacts, and without a nationally agreed upon implementation plan, we believe it will have serious and detrimental impact on the national economy.

Ratifying Kyoto without a full public understanding of the implications, and without a full understanding and commitment from Canadian business, governments and individuals will be nothing short of disastrous for our national, provincial and territorial economies.

Alberta must continue to enhance its leadership in managing the risks of climate change through clear and demonstrable actions and solutions aimed at reducing greenhouse gas emission. At the same time, Alberta will continue to work with the other provinces and territories to influence the federal government and the national process to ensure whatever commitments are in place are in Canada's best environmental *AND* economic interests.

Albertans & Climate Change:

Managing Environmental & Economic Risks

Appendix A

An Assessment of the

Economic Impacts of the Kyoto Protocol

February 2002

EXECUTIVE SUMMARY:

Alberta is committed to taking effective action on climate change while balancing economic risks and realities for Alberta consumers, business and industry. Alberta has committed to work with other Canadian governments to develop national policies that meet the objectives, principles and outcomes stated by all governments. It is also committed to taking effective action in Alberta, recognizing that these investments will take some time to actually change the trajectory of emissions intensity.

The Kyoto Protocol sets out a specific target, without clear costs, economically or in terms of other objectives of Canadian governments. In December 2001, the Alberta Government reviewed current analysis of the costs of implementing the Kyoto Protocol. From that review we learned:

- There is a large range of estimated costs of implementing Kyoto. The costs vary because of the:
  - Size of the challenge is a moving target
  - Competitiveness impacts for Canada of the U.S. opting out of Kyoto are not understood
  - Price range for offsets on International markets will directly affect Canada's costs of compliance

- There is a need for jurisdictions to commit to a process to jointly determine a national climate change plan with clear rules that will limit costs, liability and competitiveness risks. Clear rules will improve our ability to forecast the costs and predict who will bear them. In particular, it will be important to consider who bears the burden and in what proportion: sectors that compete on international markets; the general public; and governments

The Analysis Understates the Risks

On balance, the occasionally optimistic assumptions of the analysis, the failure to deal with the risk of investment flight, the low gap estimate and the risks of distorting trade and investment relations with the U.S. lead to the conclusion that there is high upside risk. This is also related to the lack of any clear policies to limit costs and manage risks.

- There is considerable risk to the Alberta and Canadian economies:
  - Risk that current optimistic assumptions will not be fulfilled
  - Risk that the reduction burden is larger than forecast
  - Risk that both domestic and international reduction prices will be greater than expected
  - Risk that policy uncertainty and poor policy choices would impose costs that lead to investment flight

We determined that there are a number of steps that should be taken to improve confidence in understanding the risks to the Canadian economy:

- Further analysis needs to be based on very specific policy options
- We need informed consultation with stakeholders and the public
- We need federal and provincial agreement on specific policies to reduce uncertainty, set the framework and manage the outstanding risks associated with the Kyoto Protocol

ALBERTA REVIEW OF RANGE OF KYOTO IMPACTS:

In December Alberta reviewed our current understanding of the costs of implementing Kyoto. The review was largely based on taking a critical look at the national analysis conducted under the National Climate Change Process by the Analysis and Modeling Group. This was complemented by some microanalysis of key Alberta sectors.

Based on the range of results and the uncertainty both captured in the national analysis and identified by during the Alberta review, the results were put into a "range" and risk management context.

Because of the need to forecast multiple variables, it is clear that there are no definitive single conclusions that can be drawn from the analysis. Costs must be understood in terms of the range of risks. Policy clarity will help narrow risks by improving our ability to predict costs and economic impacts. However, in addition to policy clarity Canada's policy approach must be deliberately designed to improve our ability to manage the risks.

Wishing for optimistic outcomes won't make them come true

Single point forecasts ignore the real range of uncertainties and risks. Only by being explicit about risks and uncertainties can we identify, consult and agree on the policies needed to minimize costs and manage risks.

Size of the challenge is a moving target

The first uncertainty is the size of the reduction challenge posed by the Kyoto Protocol. National analysis was based on a precise forecast of emissions growth – the Business as Usual (BAU) case. Our experience in forecasting that challenge has not been good: since it was first forecast as a 160 megatonne challenge in 1997, it has been revised upward every two years by about 40 megatonnes, to 240 megatonnes as of January, 2002. These increases in projected emissions have been necessary because we have consistently underestimated the economic growth that Canada, and Alberta in particular, has been experiencing.

Even these biannual updates may be understating the size of the challenge since they do not reflect all the emissions growth expected in Alberta resulting from planned private sector oil sands development. There are likely several other sectors across the country with expected expansions that have been understated in the analysis. If we have done so in one important sector, it is very likely that we have done so in others.

Alberta's review suggested that the forecast underlying the national phase one analysis was some 40-80 MT too low. In addition to the problem assumptions made about oil sands development and economic growth, the national analysis assumes a significant shift from coal to natural gas in Alberta's electricity sector. More recently, an additional 2,300 megawatts of coal-fired electricity generation has been proposed to come on-line over the next five to six years. This would mean an increase in emissions from coal-fired power generation rather than a reduction.

The size and cost of the gap or challenge forecasted by the national economic analysis are also underestimated because they assume that a number of actions that will reduce emissions will be made and be effective.

Forecasted "Business-As-Usual" scenarios assume reductions

The business-as-usual (BAU) emission rates forecasted in the national analysis assume the implementation of some domestic reduction actions, and therefore underestimate the size and cost of the reduction challenge facing Canada. In effect, the BAU forecast is a "reduction scenario".

The BAU forecast attempts to capture current policy and incorporates a pattern of on-going energy efficiency improvements across the economy. There is some "continuous improvement" built into the base case. This makes it difficult to determine which reductions are related to new programs, and which related to continuous improvement.

The business as usual case should be the case without new climate change measures. In other words, new programs must be understood as addressing the gap, and with program costs included in the "costs of Kyoto".

Competitiveness impacts for Canada of the U.S. opting out of Kyoto are not understood

The first phase of the national analysis was conducted prior to the withdrawal of the U.S. from the Kyoto Protocol. Since the United States is Canada's major market, as well as our major competitor, the implications for the competitiveness of Canada's goods on U.S. and world markets have not yet been studied.

A moving target

Canada's Kyoto Gap, the difference between projected emissions and a target rate of six per cent below 1990 emission levels, has been growing.

- The gap is itself uncertain, a prediction depending on economic activity and policy. These will only be known after the fact.

Estimates of the gap have been growing:

- 1997: about 160 MT gap estimated
- 1999: about 200 MT gap estimated
- 2001/2: about 240 MT gap estimated
- 2003, 2005, 2007, 2009, 2011 – will the gap continue to grow by 40MT every two years?

The gap is increasing in part because of other priorities such as jobs, economic regional development, developing secure energy resources for Canadian and US markets.

It is very likely that if Canadian goods include an embodied carbon charge and the goods that they compete with do not, the Canadian goods will be put at a disadvantage. The magnitude of that disadvantage would depend on the amount of embodied energy/carbon in a product and the market price of carbon emissions.

If faced with these costs, in order to maintain their international competitiveness, some industries, like car manufacturers, petrochemical companies and oil refineries might choose to make their investments outside Canada.

The non-involvement of the U.S. in the Kyoto Protocol will also have a number of other implications for modeling:

- The U.S. will not experience any Kyoto-induced economic slowdown so Canada might benefit from on-going demand (which helps overcome its own slowdown);
- The U.S. will not officially participate in international emissions trading, which may reduce prevailing international reduction prices.

Price range for offsets on international markets will directly affect Canada's costs of compliance

The cost to Canada of meeting a Kyoto target will be decided by a combination of the costs of domestic reductions and the cost of purchasing international offsets. Where the costs of domestic reductions exceed the cost of international offsets, Canada can keep the costs of Kyoto compliance down by buying those international offsets until it reaches its Kyoto quota. Any policies that limit the access, or predetermine a balance between the use of domestic reductions versus international offsets, would increase the cost of Canada complying.

There is a great deal of uncertainty about international prices so this is a key risk that requires management. Expectations of low prices are based on non-participation of the U.S., an assumption that contradicts the basic logic of Kyoto. Moreover it assumes an abundance of Russian "hot air" without any Russian attempt to exercise market power. Finally, some observers believe that without the U.S., Canada will be the largest international credit purchaser thus influencing and exposed to international prices. Since this is an uncontrollable factor, it requires a risk management policy.

Risk of de-linking North American markets

The risk of creating different rules and different costs for competitors in the broad North American market creates a real risk of decreased competitiveness, loss of investment and loss of trade. Canada would be the only partner in NAFTA that is subject to an emissions target under the Kyoto Protocol. A continental energy policy could also be jeopardized by Canada's commitment to a Kyoto target.

THE PATH FORWARD FOR ECONOMIC ANALYSIS:

In order to proceed to an informed decision, there is additional information and analysis required:

- Need to narrow analytic range by grounding analysis in specific policy options
- Need to test analysis with involved stakeholders and general public through informed consultations
- Uncertainty kills – need to ensure there is federal provincial agreement that addresses specific policies to remove uncertainty and manage risk prior to ratification decision
- Policy approaches need considerable flexibility because there is too much uncertainty for rigid approaches
  - This means need to involve consumers
  - Need for trading system
  - Need to include all sinks and sources
- Policy approaches must include investment for future economic reductions such as technology, and in behavioral change, such as conservation
- There is a need to identify the policy approaches which lead to the desired outcomes: enhanced competitiveness; no unfair burdens; efficiency; effectiveness (in achieving reductions)
- Limiting liability seems essential to maintaining growth in key sectors, especially energy
- Approaches need to be coordinated with the U.S., or there is a risk of disrupting trade and investment flows

Improving understanding of risks to the economy

The first phase of national analysis was conducted prior to the withdrawal of the U.S. from the Kyoto Protocol. Using several scenarios, models, and sensitivities, it identified a range of outcomes.

The Alberta review captured the range – focusing on the runs that bore the closest resemblance to current expectations, and embodied the most "behavioral" rather than "theoretical" model assumptions. The *Kyoto Loose* scenarios based on the behavioral CIMS model reflects an open, relatively low-priced international reductions market with U.S. doing 75 per cent of its actions abroad.

Critical review of the analysis identified a number of factors that would broaden the range of result – factors that lead to both lower and higher cost forecasts.

Again, the most critical factors seem to be the size of the reductions gap and the risks of investment flight – especially in light of the withdrawal of the U.S., Canada's largest trading and investment partner.

It should also be noted that these models describe the eventual outcome or economic equilibrium. None of the models attempts to capture possible economic "churning" as the economy attempts to adapt to new constraints. Moreover, the modeling runs assume incremental new capital is attracted to make emissions reduction investments. This is an assumption that is difficult to reconcile with reality – capital constraints, and a competitive international market for investment capital.

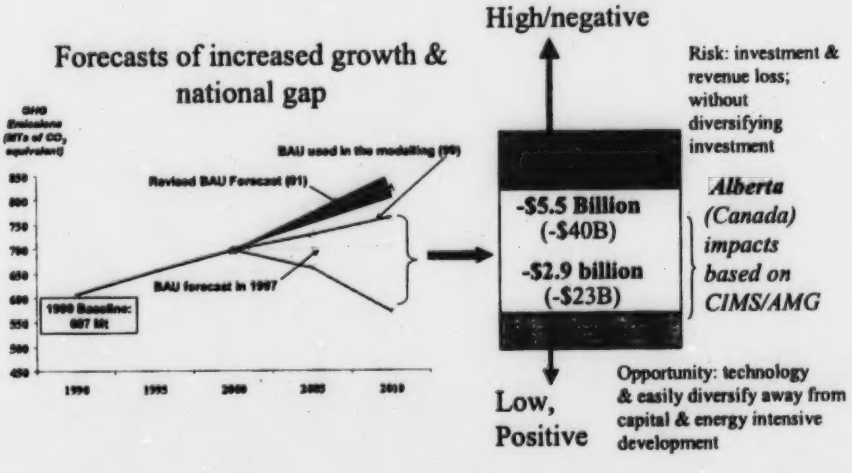
It is also clear that the models understate the longer-term (i.e., post Kyoto commitment period) potential of technological breakthroughs to reduce emissions.

Much has been made of the increase in sinks allowable under the Kyoto Protocol. While this revision of the Kyoto rules has potential to reduce the cost of Canada's meeting the Kyoto target, the cap on forestry management and projections of agricultural sinks, it is uncertain how that sink potential can be met by the Kyoto commitment period.

The national analysis tried to take into account other environmental and health benefits. These were factored into the choice of measures proposed by the original issue tables. However, these benefits were presented separately to Ministers so they could compare the "economic assessment" and the more qualitative "other benefits" assessment. It is unlikely that any of these health benefits would be evident by the commitment period.

Our review indicates a broader range of economic risks to Alberta
Based on the forecast gap in 2000, the models that try to predict behavior in the economy show a reduction in expected Alberta economic activity of between $2.9 - $5.5 billion (by 2010 in current dollars). The overall impact for the country is estimated to be $23- $40 billion dollars.

Range of National and Alberta Impacts



Sustained negative impact on Alberta

Alberta is at risk of facing a large and sustained negative economic impact if Canada were to ratify the Kyoto Protocol.

Great uncertainty remains with respect to the potential range and magnitude of impacts. Magnitude of impact will be contingent upon the specific policies adopted under the national strategy – which we can determine – and international factors which are beyond our control – and thus require active risk management policies.

Clearly there are model runs and assumptions, which deliver lower estimates of costs. Some even deliver positive results. However, such models assume:

- Complete recycling of investment in Canada – no investment flight
- Ability of new sectors to attract capital not taken up by the sectors that are our current "engines of growth"

The risk to Canada

Alberta briefly reviewed Canada in comparison with other countries. Most international comparisons show Canada as the most challenged among countries currently contemplating greenhouse gas emission caps.

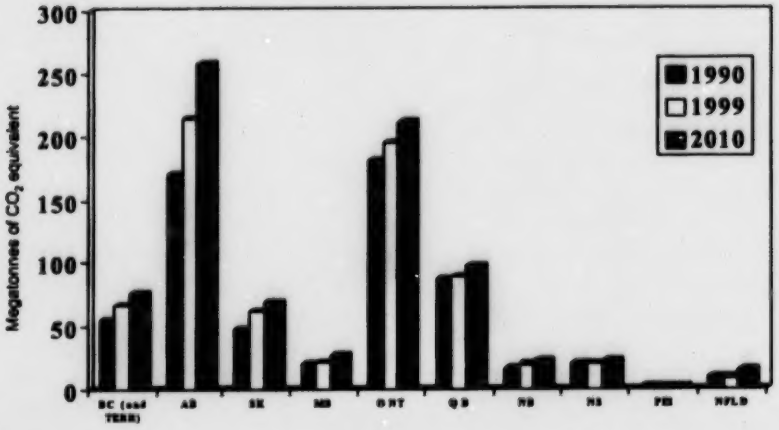
The Australian modeller, ABARE, for example, indicates that Canada's potential impact could be more than double that of Australia, more than four times that of the European Union, and almost 10 times that of Japan.

The uncertainty of the macro-economic analysis and its interpretation suggested a need to focus on more specific analysis – where are the emissions, what are the estimated cost of reductions, what would such costs means for consumers and key Alberta sectors?

Where are the emissions?

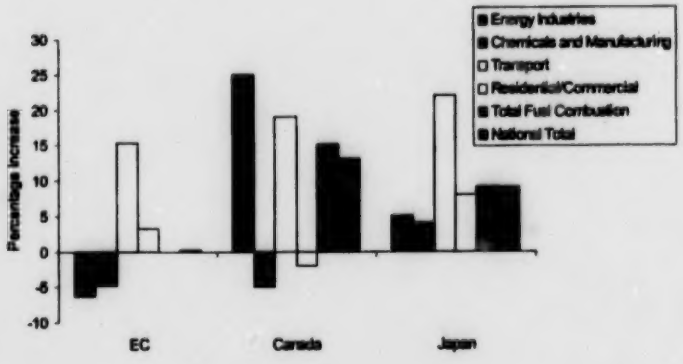
Emissions are forecast to grow in all jurisdictions. However, the growth is strongest in jurisdictions actively developing their resources.

Cross-Canada Distribution of Emissions



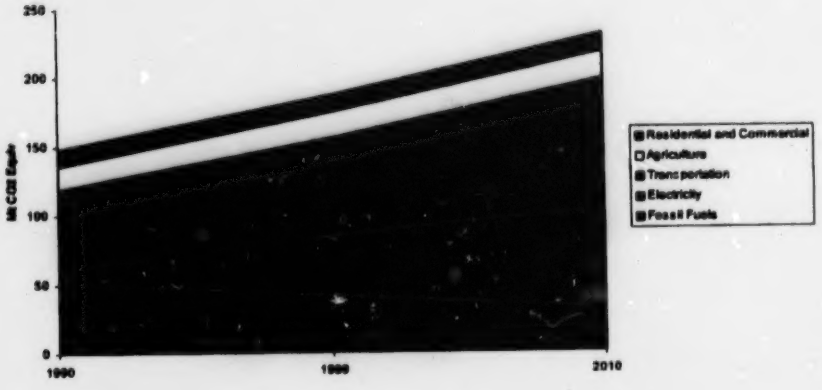
International comparisons show how unique Canada is – its emission growth is largely associated with energy development, especially export-oriented development to meet North America's growing need for secure energy.

National Emissions – 1990 versus 1998



Alberta's forecast emissions growth is fuelled by energy development. Because of the anticipated increase in oil sands and other energy development, Alberta is growing as a percentage of Canadian emissions.

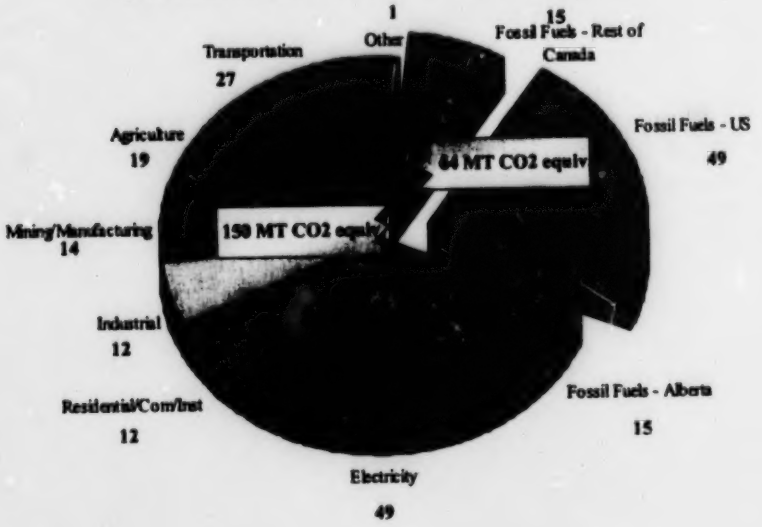
Alberta Emissions Growth: Key Sectors



Of course, a substantial portion of current Alberta emissions and Alberta's emissions growth are associated with production of energy for the U.S. and the rest of Canada.

Alberta Emissions - 1999

Upstream Ex-AB and Export O&G Attributed



Cleaner energy exports

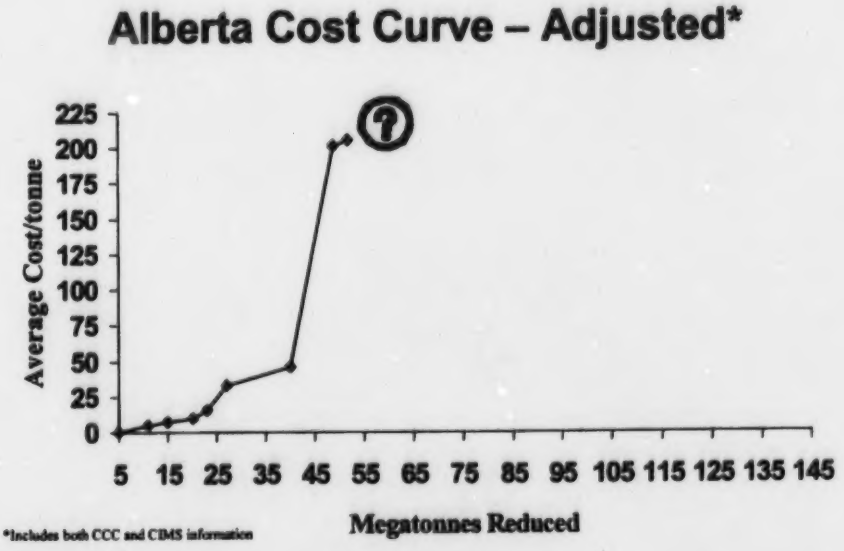
The federal government has started international discussions focused on cleaner energy exports – reflecting that energy is internationally competitive, contributing to international environmental objectives, as well as continental security concerns. Having just begun, the result of these discussions is unclear.

This is an important issue, because much of Canada's emissions growth is associated with energy development – consistent with federal and provincial policy objectives. This issue needs to be resolved in order to meet the objectives of maintaining competitiveness and avoiding undue burden – objectives or principles shared by all Canadian governments. However, satisfactory resolution of cleaner energy exports is not a panacea, but an element of the package of policies required to clearly define costs and burdens.

What do the models say about emission reductions?

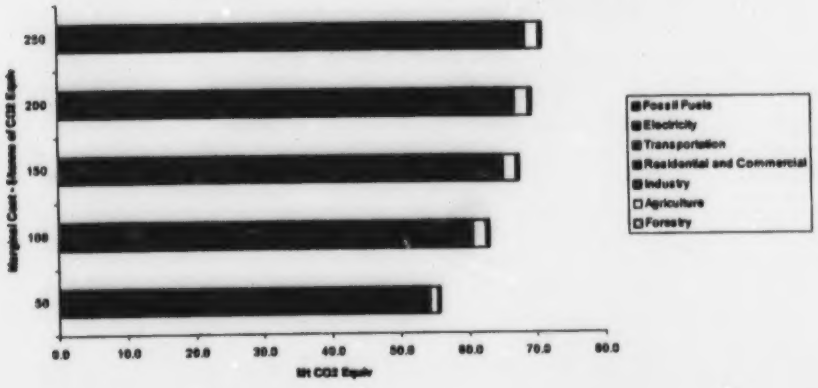
One of the products of the issue tables of the national climate change process was a preliminary understanding of the costs of reducing emissions. In reviewing the phase one analysis, it is clear that much more needs to be done to develop a "supply curve for emission reductions". There is still considerable difference of opinion about the shape of the emissions reduction curve.

The CIMS cost curve (from the national analysis) as modified by work done by Alberta's Climate Change Central results in an exponential curve with sharp inflection points at $10 and $40 per tonne. The curve suggests approximately 25 MT of reduction could be achieved for $25/tonne



The CIMS cost curve provides some indication where reductions occur, at approximately what prices.

Cost Curves - Sectoral Reduction Contribution



The largest portion of the emission reductions, at all levels, comes from the electricity sector – specifically from the thermal generation sector.

These reductions are expected to come from choice of natural gas over coal for thermal generation, and from some efficiency gains, but primarily from capture and storage in geological reservoirs of carbon dioxide.

Since the first phase analysis, North America experienced volatile natural gas and electricity prices, which have reawakened interest in diversifying thermal electric fuels, to reduce electricity price volatility. Two new thermal plants are in the approval process; a third is under discussion.

While Alberta is actively pursuing carbon capture and storage, it seems clear that the estimates in the cost curve are ambitious in terms of the timing, quantity and cost of that activity.

Costs and risks of reductions

The estimated cost curves for emission reductions seem uncertain. Some observers see them as flat – with large reductions available at relatively low prices.

From our review, it appears that cost rises quite steeply. Moreover, the cost curves assume fairly large reductions from electricity and carbon capture and storage that are uncertain in time, quantity and cost. This additional uncertainty is part of the "risk" that needs to be managed in responding to climate change.

Domestic vs. international reductions

The analysis seems to suggest a relatively limited capacity to reduce emissions at low costs, compared with the growing "Kyoto Gap". This suggests a need to rely on international reduction credits.

Indeed, ABARE suggests Canada would become the largest international credit purchaser in the absence of the U.S..

This raises a number of questions:

- Who will purchase the credits?
- What's the size of the capital outflow?
- Will Canadian emissions reduction efforts be capped at the international emissions price?
- Is there a safety valve if international prices exceed expectations?

Cost implications for energy producers and consumers

The cost curves suggest the cost of action could well be in the $10 to $25/tonne range, higher if there are policy restrictions on the ability to access the international emissions market.

This level of costs will affect both consumers and producers.

The Alberta analytic review compared the implicit value of carbon in the reduction curves with potential impact on energy commodity prices.

Risk: Increased Cost Of Energy Production Only Half The Story

$/tonne CO_2e	Electricity $/KWh	Conventional Oil/bbl	Heavy oil/bbl	Synthetic/bbl	Natural Gas/Gj
$10	$0.01	$0.30	$0.58	$0.90	$0.05
$24	$0.02	$0.71	$1.40	$2.16	$0.13
$45	$0.04	$1.33	$2.62	$4.05	$0.24
$58	$0.06	$1.71	$3.38	$5.21	$0.30
$250	$0.25	$7.38	$14.55	$22.48	$1.30

For example, a reduction burden of $10/tonne CO_2e (CO_2 equivalent) is equivalent to about a dollar in costs on synthetic crude oil.

In a world where oil sands investment is "marginal" – based on comparing an average price of $18- $20 U.S. against a "supply cost" of essentially the same range – additional costs will frustrate investment, in favor of non-annex one countries with no Kyoto costs.

If the costs are visited on the oil supply sector, the result will be both investment flight and loss of government revenues.

Alberta's analysis shows a potential impact on provincial government revenues of $225 million per $10/tonne CO_2e costs from existing oil and gas operations. This understates the revenue impact, because it does not take into account foregone revenue from lost investment, or associated income and other tax revenues.

Alberta's oil sands are abundant and accessible sources of crude oil. With the continuing decline of conventional North American crude oil reserves, the focus is turning towards oil sands development and production. Oil sands production for 2000 averaged 605 thousand barrels a day, representing 30 per cent of Canada's crude output. By 2005, oil sands production is expected to account for 50 per cent of total Canadian crude oil output and 10 per cent of North America's output. Based on existing and announced investment of over CDN$55 billion, it is expected that oil sands production will almost triple by 2010.

In associated work, CAPP has summarized the currently planned investment, the investment at risk, and the associated employment and production.

Industry Says Impacts Could Be Higher

	Jan. 2001	Jan. 2002
Projects Announced	**$51 billion**	**$86 billion**
• Completed since 1996	$11 billion	$17 billion
• Under construction	$10 billion	$ 7 billion
• At Risk/Under Evaluation	$30 billion	$62 billion
• Forecast (business risk)	$17 billion	$25 billion
Government Revenue (30 yrs)	**$250 billion**	**$325 billion**
Jobs	**70,000/yr**	**90,000/yr**
Production	**2 million total**	**2.6 million**

Alberta's oil and natural gas exports go almost exclusively to the United States. From the U.S. perspective, Alberta's market share in the U.S. is as follows: 11 per cent of the natural gas market as compared to one per cent for the non-Annex B countries, five per cent of the crude oil market as compared to 36 per cent for the non-Annex B countries.

Alberta production is a price taker in the U.S. market. This means that any costs for greenhouse gas emission reduction increases the costs of operation. What this means is reduced activity, reduced investment and reduced revenues.

Costs of GHG reductions

Testing GHG reduction costs against the economics of specific sectors shows the vulnerability of investment, jobs and revenues to policy choices. Unless policies are specific, the impacts can be dramatic.

It is estimated that at present the average operating cost per barrel of oil is $5.40 in Alberta. If industry was confronted with $10/tonne reduction costs, this could be equivalent of a five per cent (light and medium) to 10 per cent (heavy oil) increase in operating costs.
Alberta's analysis indicated a cumulative three per cent annual reduction light and medium conventional oil production from new wells resulting in a 34 per cent drop in production after 10 years. Similar impacts would be seen for heavy oil.

The national analysis assumed that Canadian natural gas exports would increase to compensate for lower development and returns in other commodities. However, high levels of a natural gas exploration and development have been required simply to maintain production. Despite higher than forecast prices, the EUB is forecasting a decline in natural gas production post 2003. This suggests that some of the offsetting GDP growth in the national analysis may not occur.

Other tests of pricing levels

Comparing reduction costs with forecast emission reductions, suggests costs that would create real difficulty if, for example, the energy sector faced those costs. The costs also seem dramatic when traced through to consumers.

The analysis forecasts a higher cost. There is risk of much higher consumer energy prices in the short term.

Emerging opportunities

The Alberta review considered the technology opportunities for advancing Alberta's energy economy. These included: carbon dioxide capture and storage, broad energy sector technology development, increased natural gas development, especially coal bed methane, increased energy efficiency, biological sequestration, trading and adaptation.

The review concluded that while the opportunities required further evaluation and investment, substantive results would not be felt in the 2010 timeframe, they would be seen a decade later.

CONCLUSIONS:

There is a broad range of analytic results:

- It is important to understand it as a legitimate range, and to take deliberate action to drive costs to the low end of the range, and to put in place policies to manage risks outside our control.
- What we are dealing with is inherently uncertain – deriving false comfort from optimistic conclusions will leave us unprepared and increase uncertainty and skepticism.
- The national analysis broadly understates the risk range, and there is greater upside risk.
- Policy certainty is required in order to narrow the cost range.
- Macro-economic outcomes are difficult to interpret. Numbers that seem small are large compared with other countries.
- Emission projections may be optimistic in price and quantity and also in time. In several areas, immediate action is required, but the investments will only achieve reductions in the future.
- Despite optimistic assumptions, reduction costs quickly mount above expected international prices:
  - Policy constraints, which limit access to international markets or require specific proportions of domestic reductions risk increasing higher than international costs.
  - International prices may prove volatile; they are unreliable safety valves.

- When tested against key sectors, such as oil and gas, the projected costs of ghg reductions will discourage new investment and erode current operations:
  - Simply levying costs on all sectors will prove costly and counterproductive.
- Growth in the oil sands, strategic to Canada's North American secure energy supply role, is endangered by perceived exposure to GHG costs.

Despite the best mitigation efforts and successes world governments have already made to reduce greenhouse gas emissions, there will likely be longer-term impacts on future generations. Consequently, we need to start now in order to make a difference.

We will also need to plan and adapt to the impacts of climate change.

Alberta recognizes and strongly agrees that climate change is a growing concern to all Canadians, and there is no question that some action must be taken to address the issue.

However, as a province we are just as concerned about our nation's competitiveness and economic well being. Specifically, our concern stems from the fact that much of the work and analysis of the National Climate Change Process, established in 1997, was undertaken before the decision by the U.S. to withdraw from the Kyoto Protocol.

With the importance of trade and investment between Canada, the U.S., and Mexico, actions or programs undertaken by Canada to address climate change must be developed in a North America context. Discussions on climate change between Canada, the U.S. and Mexico are vital to ensuring Canadian business and industry is on a level competitive playing field with economies that are so closely linked to our own.

Alberta has identified a considerable range of risks, which must be explicitly addressed through specific analysis, informed consultation with stakeholders and our publics, and through agreed-upon policies to limit costs and manage risks.

We cannot overstress the importance of making a fully informed decision.

Albertans & Climate Change:

Managing Environmental & Economic Risks

Appendix B

A Summary of Alberta Actions to Date

February 2002

Alberta Environment

INTRODUCTION:

Responding to climate change is a huge task, demanding a wide range of innovative partnerships that are flexible, dynamic and able to adapt to meet the demands of changing scenarios.

The following appendix is a summary of some of the key actions that Albertans are taking to reduce greenhouse gas emissions under the thematic headings:

- Conserve
- Lead by Example
- Capture and Store
- Innovate
- Develop Tools
- Adapt
- Influence

CONSERVE:

Conserving energy - through energy efficiency or alternative power sources - is one of the most cost-effective ways of reducing greenhouse gas emissions. The Alberta government is encouraging Albertans to pursue a range of opportunities that can reduce energy consumption and save them money as well as reduce the related emissions.

GOVERNMENT OF ALBERTA:

Removing barriers to small-scale generation
The Alberta government is working with the electricity sector to facilitate the installation of new, smaller scale electricity generation that is more responsive to the electricity needs of the consumer. This will ultimately result in fewer greenhouse gas emissions.
http://www.energy.gov.ab.ca/com/Electricity/Key+Publications/Key+Publications/New+Generation+Brochure+-+Section+1.htm

Best practices for the farm and food processors
Alberta Agriculture, Food and Rural Development is working with the agriculture sector and with the Alberta Food Processors Association to develop education and awareness programs. These programs are aimed at food producers and processors to educate them on best practices and new technologies to reduce greenhouse gas emissions on farms.

Natural gas for Metis Settlements
The Alberta government, under a cost-sharing rural gas grant program, is bringing natural gas service for the first time into Buffalo Lake and Kikino Metis Settlements in northern Alberta. Natural gas is cleaner burning and less carbon-intensive than the diesel and propane formerly used on the Settlements. Full natural gas service is expected to be in place for the Metis settlements by spring 2002.

Less wasteful industry
The Alberta government is working with stakeholders to present a conference series on the redesign of industrial processes to mimic natural systems, optimize the use of resources and essentially eliminate waste. These "industrial ecology" conferences will provide local industry with access to international experts and act as a platform to share information, build capacity and develop networks.

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

Alberta eMission Banff and green corridors
Transportation is a major source of greenhouse gas emissions. This project, led by ATCO Gas, will convert 60 large passenger vans and shuttles to run on natural gas in the "green corridor" between Calgary and Banff, with natural gas refuelling stations in both those centres. http://www.climatechangecentral.com/NewsRoom/ccc_in_the_news2001a.html

Bring us your older cars
Some Calgary citizens will get a one-year transit pass or a $500 credit for a newer car when they retire their more polluting pre-1988 cars. This program, developed by the multi-stakeholder Clean Air Strategic Alliance, could be extended across the province once impact, costs and feasibility have been evaluated.
http://www.casahome.org/casa_library/bygroup.asp?idnumber=25

ALBERTA INDUSTRY:

Destination Conservation
Sponsored by private industry along with the federal government, this program is delivered in more than 50 Edmonton schools, increasing awareness and encouraging conservation alternatives that lead to improved energy, water and waste management practices at school and at home. Alberta companies involved in Destination Conservation projects include EPCOR, Suncor Energy, PetroCanada and TransCanada Pipelines. www.dcplanet.org

Alerting the business community
The Alberta government has worked with the Pembina Institute to encourage small and medium enterprises to take action on climate change, become more competitive and reduce energy costs. Interested companies or groups were offered workshops with a focus on case studies and success stories. www.pembina.org

Syncrude Canada Ltd.
More than 600 employees of Syncrude Canada Ltd., one of several Alberta energy companies taking part in the Action By Canadians on Climate Change program, have pledged to reduce their greenhouse gas emissions by an average of 2860 kg. (The minimum pledge required by the program is 2000-kg greenhouse gas emissions per person.) http://www.energy.ca/abc/index.htm

Winds of Change
Since 1999, the amount of electricity generated from wind energy in Alberta has increased from 21 megawatts to more than 200 megawatts. Power generated by these turbines reduces greenhouse gas emissions by displacing other sources of electricity - primarily older, more fossil fuel intensive facilities. Alberta expects to see this trend of increased capacity to continue over the coming years. www.energy.gov.ab.ca

***ClimateWise*: a community program**
Designed and originally implemented by the Clean Air Strategic Alliance, www.casahome.org, *ClimateWise* is a community-based public outreach pilot program on climate change and energy efficiency and is subtitled *Save Money, Save Energy, Save the Environment.*

Oxford Properties Group Inc.
Oxford Properties Group Inc. in Calgary invested extensively in energy efficiency when developing its multi-tenant, 46-floor Canterra Tower office complex. Energy conservation efforts "avoided" $1.5 million in operating costs, reduced energy consumption by 30 per cent and the building's total greenhouse gas emissions decreased by 28 per cent. As a result of this leading-edge environmental management, Canterra Tower has qualified for registration as an ISO 14001 building. www.oxfordproperties.com

Suncor Energy
Suncor Energy's focus on energy efficiency and emissions reduction over the past decade is working -- energy intensity has decreased by 12.5 per cent and greenhouse gas emissions have gone down by 30 per cent per unit of production. www.suncor.com

Capital Health Authority
Capital Health Authority's University of Alberta Hospital in Edmonton reduced its total 1999 emissions to eight per cent below 1996 levels. That's the equivalent of more than 6,000 tonnes of carbon dioxide equivalent. And, it was achieved through energy efficiency actions. The hospital is also committed to long-term energy efficiency targets, winning a VCR Inc. Leadership Award in 2000 for its efforts. www.cha.ab.ca

Burlington Resources
Burlington Resources is a winning upstream oil and gas company headquartered in Alberta. The company was awarded a VCR Inc. Leadership Award in 2000 for its public and employee outreach education program on greenhouse gas reductions, its exceptional action plan and progress report and for reducing its production energy intensity (by 48 per cent) and its product carbon intensity (by 37 per cent).
http://www.vcr-mvr.ca/ClientDetail.cfm?No=580

Conoco Canada Ltd.
Conoco Canada Ltd. managed to cut its flaring and venting of natural gas by more than 90 per cent, by modifying its existing processes and equipment. The company recouped its investment in two months, and now recovers natural gas volumes worth more than $1 million per year. Least-cost solutions to greenhouse gas emission control like this one are a cornerstone of Alberta's greenhouse gas reduction strategy.
http://www.vcr-mvr.ca/ClientDetail.cfm?No=2155

LEAD BY EXAMPLE:

The Alberta government and municipalities are demonstrating to Albertans, with actions, that greenhouse gas emission reductions can bring energy and cost savings.

GOVERNMENT OF ALBERTA:

Walking the talk
In 1995, the Alberta government announced that within five years it would reduce emissions from its operations by 14.1 per cent below 1990 emission levels. By the end of 2000 the Alberta government had exceeded its target and reduced emissions by 22 per cent below 1990 levels.

A leader in Canada
The Alberta government is the only government in Canada to have won a national leadership award three times (to date) from the Voluntary Challenge and Registry Inc., a private/public partnership established in 1997 to help reduce Canada's greenhouse gas emissions. http://www.vcr-mvr.ca/ClientDetail.cfm?No=47

"Care-fuel" driving
The Alberta government will start a pilot fuel efficiency program in 2002 to train employees in vehicle-related energy efficiency (maintenance, operation and driver behaviour).

Energy efficiency in schools
New and modernized schools in Alberta must meet the highest standards and guidelines for energy efficient technologies and materials.

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

Environmentally friendly office
Climate Change Central's Calgary office holds Environment Canada's first EcoLogo certificate. High efficiency office lighting with sensors that switch power off when a room is empty, innovative recycled floor coverings and office furniture are among the energy-saving features that helped Climate Change Central gain this certification.

MUNICIPAL GOVERNMENT:

Calgary's *Ride the Wind* project
The City of Calgary's light rail transit now runs on wind-generated electricity provided by Vision Quest Windelectric Inc. The city's C-trains still need 21,000 MWh of electricity a year to keep them going. Now, however, that electricity is 100 per cent greenhouse gas emission-free. www.calgarytransit.com/environment/environment.html

Edmonton's CO_2RE strategy
The City of Edmonton is working with local stakeholders to develop a community-wide greenhouse gas reduction strategy. This strategy will support the vision of Edmonton having zero net greenhouse gas emissions by 2050. http://www.co2re.ca/

CAPTURE AND STORE:

Carbon dioxide, once considered a useless waste product, is fast increasing in value. The Alberta government, energy industry and research community are working together on innovations that enhance petroleum recovery using this common greenhouse gas. Another "win-win" opportunity, in Alberta's search to balance a healthy environment with a healthy and sustainable economy.

GOVERNMENT OF ALBERTA:

Carbon Management Strategy
The Alberta government has developed a Carbon Management Strategy that will act as a framework of industry-government research, involve partnerships with other jurisdictions where feasible and focus on deployment and demonstration of carbon management technologies in the energy sector.

Investigating carbon dioxide storage
The Alberta government, through the Alberta Energy Research Institute (AERI) has committed to investing $150,000 in 2001/2002 in the *IEA Weyburn CO_2 Monitoring and Storage Project.* The main goal of this monitoring project is to verify the long-term storage capacity of carbon dioxide in geological formations. This study will also give credibility to geological storage as a legitimate mitigation approach for greenhouse gases. In the short-term, this project will identify new, cost effective ways to track the underground movement of carbon dioxide. Other participants include: Natural Resources Canada; Saskatchewan Energy and Mines; IEA Greenhouse Gas Programs; University of Alberta; British Geological Survey; Danish Geological Survey; and the Lawrence Berkeley National Laboratory.
http://www.ieagreen.org.uk/weyburn5.htm

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

Capture costs
Climate Change Central has co-ordinated funding from Western Economic Diversification and Alberta Environment to support a project led by the Canadian Energy Research Institute on cost estimates for injecting carbon dioxide into underground formations in Alberta. The goal of the $300,000 project is to identify the costs of capturing emissions from large emitters and storing them in deep geological formations instead of releasing them into the atmosphere.

ALBERTA INDUSTRY:

Near-zero coal
The Alberta government is partnering with an international consortium of companies to investigate a Los Alamos National Laboratories process for electricity generation with near-zero emissions.

Flue scrubbing
The Alberta government is supporting a University of Regina study into new technologies that will scrub carbon dioxide from the flue gas of retrofitted existing fossil fuel generation stations.

Methane recovery

The Alberta Research Council, with the support of provincial, national and international organizations, is starting a five-well pilot project that will test the recovery of methane, by injecting carbon dioxide and nitrogen into Alberta's otherwise unmineable coal beds.
www.arc.ab.ca

INNOVATE:

Alberta, as a key player in today's global economy, is committed to developing and adopting new technologies and innovation. Organizations like the Alberta Energy Research Institute and Climate Change Central are supporting the development and use of technologies that will help reduce greenhouse gas emissions, both in Alberta and abroad.

GOVERNMENT OF ALBERTA:

Looking at alternatives
The Alberta government is examining the technical, environmental and economic issues associated with alternative fuels.

Smarter transportation
Intelligent transportation systems cut greenhouse emissions by improving traffic flow and minimizing congestion. The Alberta government provides municipalities with dollars to tackle congestion through a variety of responses including early incident detection and "real-time" traffic signals.

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

Shopping for solutions
The Environmental Services Association of Alberta, www.esaa.org, has produced an online greenhouse gas solutions showcase, www.ghgshowcase.com, with product and service information about suppliers meeting the greenhouse gas emission reduction needs of industry. Sponsors of the showcase include Climate Change Central, Alberta Economic Development and Western Economic Diversification.

Growing Greener
Climate Change Central and Mariah Energy, in partnership with the National Research Council, Alberta Research Council, a host greenhouse, the City of Medicine Hat and Shell Canada Ltd., will install six microturbines in a Medicine Hat area greenhouse. Here, the microturbines generate electricity and supply the greenhouse with heat. Surplus electricity is sold to the grid and the carbon dioxide produced is piped into the greenhouse to boost growth of its tomatoes, green peppers and cucumbers.

ALBERTA INDUSTRY:

Mariah Energy Corp.
Mariah Energy Corp. has developed a combined heat and power generator for a 12-unit live/work condo development in Calgary by Suncurrent Industries Inc. The commercial/residential development has radiant floor heating and domestic hot water, largely supplied by waste heat from an on-site gas micro-turbine generator. Electricity generated on-site supplies the units and the excess is sold into the provincial grid. The project will reduce wasted heat by 65 per cent and carbon dioxide emissions by more than 55 per cent. www.mariahpower.com

DEVELOP TOOLS:

Harnessing the power of the market to achieve significant and sustained reductions in greenhouse gas emissions is growing rapidly worldwide. The Alberta government is working with partners in business, universities and technical colleges on pilot programs that explore least-cost emission reductions.

GOVERNMENT OF ALBERTA:

Continuous Improvement within Alberta's Electricity Sector
In November 2001, the Alberta Government asked the province's multi-stakeholder Clean Air Strategic Alliance (CASA) to recommend a new air emissions management framework for the electricity generation sector. It is anticipated that by mid-2003, CASA will provide recommendations on innovative and effective means of managing air emissions (including carbon dioxide) from new as well as existing generation facilities.

Gas plant energy efficiency assistance
Alberta Energy has begun a three-year program (2001-2004) that provides royalty credit to gas processing plant operators who develop combined heat and power (cogeneration) facilities. Co-generation reduces the waste of fossil fuels and results in significantly lower greenhouse gas emissions than conventionally produced electricity.

Going global (China, Latin America)
Also promoting clean development mechanisms and their implementation, the Alberta and federal governments, non-governmental organizations and private sector companies went on an exploratory mission to China in October 2001. The mission objective was to increase awareness of how Alberta companies can help reduce China's greenhouse gas emissions. A similar mission to Latin America is planned for June 2002.

Flaring reductions
Gas flared in Alberta in 2000 was more than one-third (38 per cent) below 1996 levels. This gas is now either being conserved or is being used to generate electricity. Harnessing this gas that would otherwise have been released into the atmosphere was made possible through the Alberta government waiving its royalty on this gas. http://www.eub.gov.ab.ca/

Call us GERT
The Alberta government was a member of the Greenhouse Gas Emission Reduction Trading Pilot (GERT), a voluntary program that tests emission reduction credit trading in Canada and encourages early action projects. Twelve GERT projects have recorded emission reductions totalling more than 792,000 tonnes of carbon dioxide. The pilot ended on December 31, 2001. www.gert.org

Costs of change
The Alberta government plays an active part in Canada's national climate change process, to ensure the implications for Alberta are appropriately represented.

Enhancing the biosphere
Alberta companies and the Alberta government are among the founding partners of BIOCAP, a national, not-for-profit research organization. BIOCAP will facilitate and coordinate research into how Canada's biosphere – principally forests and agricultural soils – can be improved and store more carbon. BIOCAP brings together the expertise of more than 120 researchers in science, engineering and social sciences. www.biocap.com

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

Carbon sinks and agriculture
The Alberta government, Climate Change Central, an inter-governmental biological sinks committee and the agriculture sector are examining agricultural greenhouse gas reduction and removal opportunities through emissions credit trading. An Alberta Agricultural Land Use Registry Pilot will help producers get credit for early action, if such a trading mechanism is ultimately developed.

Simulated trading
Climate Change Central hosted Western Canada's first greenhouse gas emissions trading simulation in 2001. The event gave participants hands-on experience of virtual trading, and an understanding of how future emissions trading markets might operate, and the possible impacts of alternative regulatory policies on the cost of compliance for Alberta firms operating in North American and global markets.
http://www.climatechangecentral.com/NewsRoom/Media%20Releases/index.html

Emission trading workshops
Climate Change Central, in partnership with the Pembina Institute, will host three half-day workshops in early 2002 on domestic emission trading for representatives of Alberta agriculture, forestry, municipalities and environmental non-government organizations.

ALBERTA INDUSTRY:

TransAlta and EPCOR Offsetting Emissions Down to Natural Gas Levels
In 2001, EPCOR and TransAlta both committed to offset the greenhouse gas emissions associated with their proposed new coal-fired generation facilities down to the level of an equivalent natural gas facility. To achieve these emission reductions, EPCOR and TransAlta will be supporting projects throughout Alberta and the rest of the world that result in real and measurable greenhouse gas emission reductions. These commitments will result in a 53-63 per cent improvement in emissions related to these facilities.

Trading the wind
The first greenhouse gas emissions trade involving a wind energy project in Canada was registered through the Greenhouse Gas Emission Reduction Trading Pilot between Vision Quest Windelectric and ENMAX Corporation. This trade allowed ENMAX to initiate its Greenmax Program, a Canadian first in residential green power purchases.

Weyerhaeuser Co.,
Weyerhaeuser Co., www.weyerhaeuser.com, plans to cut its electricity bill in half with a proposed 80-megawatt power plant using wood waste at its Grande Prairie pulp mill.

TransAlta
In 2000, TransAlta completed the first ever transatlantic trade of carbon dioxide emissions reductions with the German electric company HEW. The 24,000 tonne emissions reduction trade gained from HEW wind energy facilities in Hamburg is equal to the annual emissions from approximately 3,000 cars. TransAlta has already reduced its net Canadian emissions more than 3 million tonnes below its 1990 emission level. The company says it will reduce its Canadian net greenhouse gases emissions to zero by 2024. www.transalta.com

ADAPT:

The world's climate is changing and will continue to do so. The Alberta government is working with resource managers, municipalities, the agriculture sector and other governments on the research needed for sound decision-making and risk management associated with climate change.

GOVERNMENT OF ALBERTA:

Supporting Adaptation on the Prairie

The Alberta government participates in the Prairie Adaptation Research Collaborative, www.parc.ca, a federal/regional initiative to fund research on climate change adaptation in the prairies. To date it has funded 37 projects worth more than $1.2 million.

Impacts and adaptation research

To help assess the science, impacts and adaptation aspects of climate change in Alberta, the Alberta government has funded recent projects on how Alberta conifer populations respond to potential climate change moisture stress, tree growth and development and assessing extreme weather events on the prairies.

INFLUENCE:

The Alberta government works with the federal government and Canada's other provinces and territories to see that Canada's national and international climate change positions are efficient, effective and equitable and delivers conservation and climate change education and outreach, in partnership with Climate Change Central and others.

GOVERNMENT OF ALBERTA:

A national window

The Alberta government continues to co-lead Canada's national climate change process through the National Air Issues Co-ordinating Committee on Climate Change, www.nccp.ca. This committee helps ensure that all governments in Canada work co-operatively on climate change and that Ministers of Environment and Energy are briefed on issues relating to the potential ratification of the Kyoto Protocol.

International negotiations

Alberta's Environment Minister and key staff members were part of the Canadian delegation that attended the Bonn negotiations in 2001 to present Alberta's position on key issues related to the Kyoto Protocol.

Climate change in schools

The Government of Alberta initiated a pilot, school-based activity and awareness campaign on climate change for eight Grade 5 classes in Lethbridge. A teacher resource package, including lesson plans, has been created by Alberta Environment to support the program. This pilot is being expanded, with links to Social Studies and Health and to Grades 4 and 6.

Food for thought

Alberta Agriculture, Food and Rural Development and the Alberta Environmentally Sustainable Agriculture Council, www.agric.gov.ab.ca/sustain/aesaprog.html, have produced a series of information bulletins on "things you should know about greenhouse gases" plus a workbook on greenhouse gas mitigation for the agricultural manager.

CLIMATE CHANGE CENTRAL PARTNERSHIPS:

There's the Hub

Climate Change Central, whose mandate includes education and capacity building, will serve as Alberta's public education and outreach regional hub in Alberta. The Hub will carry out regional activities; identify gaps and support activities to address them; identify and co-ordinate local partners; provide training regionally and record and share knowledge on pilot programs.

http://www.climatechangecentral.com/NewsRoom/Media%20Releases/Jun1401_InfoCentre.html

High school students and climate change
In partnership with SEEDS Foundation, www.greenschools.ca, and the Climate Change Action Fund, Climate Change Central is developing a climate change program for Canadian high school students to help them to understand climate change and to deal with the issues involved.

Competitive advantages
Climate Change Central is sponsoring an Alberta high school competition to develop practical solutions in response to climate change. Proposals can range from technical improvements, resource restructuring and public outreach programs to development of new technologies. Climate Change Central will then partner with industry so that winners can implement their projects. Winning proposals to be displayed at a Climate Change Fair during Environment Week.

Science Alberta Foundation
Science Alberta Foundation has unveiled a province-wide climate change awareness campaign. A simulcast public forum will link Calgary, Edmonton and Grande Prairie in March 2002 as part of this campaign. Science Alberta Foundation's new website will be up and running in mid-February. www.sciencealberta.org